FORM PTO-1390 (REV 12-29-99) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER: DP-300895

U.S. APPLICATION NO. (If known, see 37 CFR 1.5): 09/807086

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/US00/22305	15 AUGUST 2000	16 AUGUST 1999

TITLE OF INVENTION: ENGINE COOLANT CONDUIT WITH INTEGRAL ALTERNATER AND EXHAUST GAS RECIRCULATION VALVE

APPLICANT(S) FOR DO/EO/US: BOYD ET AL

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ■ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ■ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☐ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☐ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ has been transmitted by the International Bureau. COMP. COPY ATTACHED
   c. ■ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ■ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ■ have been transmitted by the International Bureau. COMP. COPY ATTACHED
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☐ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☐ A FIRST preliminary amendment.
    ☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☐ Other items or information:

I hereby certify that this document is being deposited with the United States Postal Service as Express Mail Post Office to Addressee addressed to Assistant Commissioner for Patents, Washington, D.C. 20231 on: **APRIL 09, 2001.**

Express Mail Label No: **EL 758057728 US**
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Name: Lowell M. Train

US APPLICATION NO. (if known, see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
09/807086	PCT/US00/22305	DP-300895

	CALCULATIONS PTO USE ONLY
17. ■ The following fees are submitted:	
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):	
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO $970.00	
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO $840.00	
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO $690.00	
International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) $670.00	
International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) $96.00	
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 670.-
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	$ —

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	
Total claims	9 - 20 =	—	X $18.00	$ —
Independent claims	1 - 3 =	—	X $78.00	$ —
MULTIPLE DEPENDENT CLAIM(S) (if applicable)		—	+ $260.00	$ —
TOTAL OF ABOVE CALCULATIONS =				$ —
Reduction of 1/2 for filing by small entity, if applicable. A Small Entity Statement must also by filed (Note 37 CFR 1.9, 1.27, 1.28).				$ —
SUBTOTAL =				$ 670
Processing fee of **$130.00** for furnishing the English translation later than ☐20 ☐30 months from the earliest claimed priority date (37 CFR 1.492(f)).			+	$ —
TOTAL NATIONAL FEE =				$ —
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property			+	$ —
TOTAL FEES ENCLOSED =				$ 670
			Amount to be: refunded	$
			charged	$

a. ☐ A check in the amount of $_____ to cover the above fees is enclosed.

b. ■ Please charge my Deposit Account No. 50-0831 in the amount of $ 670 to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ■ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 50-0831. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

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REGISTRATION NUMBER

UNDER THE PATENT COOPERATION TREATY
BEFORE THE INTERNATIONAL SEARCHING AUTHORITY

In regard to international application:

Serial No.	**PCT/US00/22305**
Applicant:	**DELPHI TECHNOLOGIES, INC.**
Filing Date:	**15 August 2000**
Title:	**ENGINE COOLANT CROSSOVER ASSEMBLY**
Applicant's Reference:	**DP-300895**

To: **International Bureau of WIPO**
34, chemin des Colombettes
1211 Geneva 20, Switzerland
Facsimile No.: (41-22) 740.14.35

I hereby certify that this correspondence is being transmitted via facsimile on the date indicated to the International Bureau of WIPO at facsimile No. (41-22) 740.14.35.

09-JAN-01
Date of Deposit

John A. VanOphem
Registered Attorney

Signature

AMENDMENT UNDER ARTICLE 19

Gentlemen:

Attached please find replacement pages 7 and 8, replacing the original claim pages 7, 8, and 9 included with the application as filed. Originally filed claims 1 through 6 have been cancelled from the application, leaving new claims 1-9 which are directed to the external coolant conduit assembly as claimed in originally filed claims 7-15.

As the remaining claims all define an assembly of an electrical generating device, such as an alternator, and a second accessory, such as an EGR valve, mounted in the external coolant conduit assembly, they differ from the patents cited in the international search report which do not teach or suggest the combination of an electrical generator in an external coolant conduit, such as a crossover or manifold. US 5,666,930 A does not show an electrical generator mounted in the crossover 40 (as for cooling of the generator) but a throttle body mounted on the crossover for conducting

heat to the throttle body. Further, the EGR valve 80 is not mounted in heat transmitting relation to the coolant passages 42, 44. Instead, it is mounted above and in the exhaust gas passage 46 and is located to one side of the coolant passages 42, 44, which extend between the flanges 36-36 and 38-38, as shown in figure 3 of the drawings. Thus, US 5,666,930 A cannot be combined with the other cited patents to render the claimed subject matter obvious.

It is respectfully submitted that the claims as amended are in condition to receive favorable examination.

Respectfully submitted,
DELPHI TECHNOLOGIES, INC.

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enclosure:

CLAIMS

1. An external coolant conduit assembly (10) for connection between engine components in a coolant circuit of an engine, said assembly (10) comprising:

a conduit member (12) mountable to said components and defining a coolant passage (24) extending between an inlet (26) and an outlet (28) to the passage (24) in the member (12);

an electrical generating device (14) mounted in the member (12) in heat transmitting relation to the coolant passage (24) intermediate the inlet (26) and outlet (28); and

a second engine accessory (16) mounted in the member (12) in heat transmitting relation to the coolant passage (24) intermediate the inlet (26) and outlet (28).

2. An assembly as in claim 1 wherein said conduit member includes an inner wall defining a cavity in heat transmitting relation to the coolant passage and said generating device is mounted in the cavity.

3. An assembly as in claim 2 wherein said inner wall comprises an outer wall of the generating device.

4. An assembly as in claim 1 wherein said inner wall includes cooling fins extending into said coolant passage for increasing cooling of the generating device.

5. An assembly as in claim 1 wherein said generating device is an alternator.

6. An assembly as in claim 1 wherein said second engine accessory is an EGR valve operable to control exhaust gas flow between inlet and outlet ports in the conduit member.

7. An assembly as in claim 6 wherein said coolant passage extends in heat exchange relation to at least a valve body portion of the EGR valve.

8. An assembly as in claim 1 wherein said conduit member is a crossover for connection between coolant passages in opposite banks of a V-type engine, said crossover also defining a thermostat housing in the coolant passage and mounting a coolant temperature sensor extending into the coolant passage.

9. An assembly as in claim 1 wherein said conduit member is integrated as part of an engine intake manifold.

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ENGINE COOLANT CONDUIT WITH INTEGRAL ALTERNATER AND EXHAUST GAS RECIRCULATION VALVE

CROSS REFERENCE TO RELATED APPLICATION

This application claims the benefit of United States Provisional Patent Application Number 60/149,141, filed August 16, 1999.

TECHNICAL FIELD

This invention relates to engine cooling and to cooling of engine accessories mounted within a conduit member such as a coolant crossover member.

BACKGROUND OF THE INVENTION

Increased use of electronics and electrical devices on automobiles has increased the load on charging systems and driven a need for more efficient higher output alternators. A method used to increase the efficiency of the alternators is to liquid cool them rather than the traditional air-cooling. These liquid cooled alternators use the engine coolant, routed through the outer housing of the unit, to cool the electronics and allow more efficient internal geometry. Normally the alternator is bracket mounted to the front of the engine and the coolant is routed to the alternator via a flexible line secured by clamps. A second set of hoses and clamps then routes the coolant from the alternator back to the engine coolant system.

Exhaust gas recirculation valves (EGR) also need to be liquid cooled to improve their performance and extend their usable life. Traditionally engine coolant is passed through an EGR valve mounting block or pedestal. The EGR is an emissions control device that admits exhaust gas into the inlet air of the engine. This exhaust gas is allowed into the intake air during certain engine operating conditions and is used to

control the tail pipe emissions of the engine. The high temperature of the exhaust gas, that the valve controls, drives the need for valve cooling.

A coolant crossover, traditionally used on a V style internal combustion engine, carries the engine coolant from one bank of the engine to the opposite bank as part of the engine coolant circuit. This coolant crossover is commonly part of the intake manifold, or can be a separate stand-alone part, and frequently contains the housing for the coolant thermostat and provisions to mount the coolant temperature-sending unit.

SUMMARY OF THE INVENTION

The present invention provides an external coolant conduit member such as an engine coolant crossover, intake manifold or other conduit member mountable between engine components, such as cylinder heads, in a coolant circuit of an engine. The conduit member includes a body defining a coolant passage extending between an inlet and an outlet to the passage. A first mount is provided for mounting in the body an electrical generating device, such as an alternator, in heat transmitting relation to the coolant passage between the inlet and outlet. A second mount may be provided for mounting a second engine accessory, such as an EGR valve, in heat transmitting relation to the coolant passage between the inlet and outlet.

The invention also provides an external coolant conduit assembly having a conduit member, such as a coolant crossover optionally integrated with a manifold. The assembly includes an alternator, or other electrical generating device, and an EGR valve, or other engine accessory, mounted in the conduit member in heat transmitting relation to a coolant passage therein for cooling the integrated elements. The assembly may also include features such as a mounting for a thermostat and a coolant temperature sensor mounted in the conduit member and extending into the coolant passage.

The integration of these features to a coolant crossover eliminates many parts from the total engine assembly. These parts include; attachment brackets, coolant hoses, hose clamps, cast mounting blocks, coolant tubes and attachment bolts. Reduction of these parts reduces system costs, reduces system assembly time, reduces vehicle mass and eliminates many potential coolant leak paths.

These and other features and advantages of the invention will be more fully understood from the following description of certain specific embodiments of the invention taken together with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a pictorial view of a coolant crossover assembly with integrated alternator, EGR valve and other elements according to the invention;

FIG. 2 is a cross-sectional view of the coolant crossover showing the internal coolant passage and some of the components mounted in the crossover; and

FIG. 3 is a pictorial view showing a coolant crossover as in FIG. 1 integrated into an intake manifold of an integrated air fuel module for mounting on a V-8 engine.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In a preferred embodiment, the invention provides an engine coolant crossover with an integral liquid cooled alternator and cooled exhaust gas recirculation valve. The integration of one or both of these parts to the coolant crossover eliminates many parts from the total assembly. These parts include; attachment brackets, coolant hoses, hose clamps, cast mounting blocks, coolant tubes and attachment bolts.

Reduction of these parts reduces system costs, assembly time, mass and potential coolant leak paths.

Referring first to FIG. 1 of the drawings in detail, numeral 10 generally indicates a coolant crossover assembly for use with a V-type engine. The assembly is intended for mounting on the cylinder heads of the engine or on coolant passage defining portions of a cylinder block, not shown. Crossover assembly 10 includes a conduit or crossover member having a body 12 in which are preferably mounted an alternator 14, an exhaust gas recirculation (EGR) valve 16, a coolant temperature sensor 18 and a thermostat, not shown, mounted in a housing 20 of the body 12. A thermostat cover 22 mounts on the housing 20 and retains the thermostat in its operating position in the housing. A pulley 23 is mounted on the front of the alternator for driving the alternator by a drive belt from an associated engine, not shown.

Referring now to Fig. 2, the conduit member or body 12 defines an internal coolant passage 24 having a coolant inlet 26 at one end and a coolant outlet 28 at the other end, at the bottom of the thermostat housing 20. A second outlet 30 is provided at the top of housing 20 for coolant directed by the thermostat through the cover 22 to the coolant radiator, not shown. The coolant temperature sensor 18 is mounted in the body 12 next to the thermostat housing 20 and extends into the coolant passage 24 for sensing the coolant temperature passing out of the engine.

The inlet end of the crossover member body 12, defines a mount 32 in which the EGR valve 16 is received with a valve body 34 extending into a recess of the mount. An inlet port 36 connects the EGR valve body 34 with a source, not shown, of engine exhaust gas. An outlet port 38 connects the valve body 34 with a conduit 40 leading to an engine manifold intake passage, not shown. A thin wall portion 41 of the mount 32 places the EGR valve body 34 in heat transmitting relation with the coolant passage 24 for carrying heat from the EGR valve to coolant in the

passage. The heat rejection may be increased by providing a branch passage 42 for coolant flow, wherein passage 42 at least partially surrounds the EGR valve body 34.

Between the passage inlet 26 and outlet 28, the crossover member 12 includes an enlarged opening 44 defined by an inner wall 45 having a plurality of mounting ears 46. An outer wall 48 is spaced outward of the inner wall and forms semicircular flow paths in the passage 24 carrying coolant around the inner wall 45. The inner wall with the mounting ears 46 forms a mount for the electrical alternator 14, which is received in heat exchange relation with the coolant passage 24 through the inner wall 45. Cooling fins 50 may be provided on the inner wall 45 for increasing heat transfer from the inner wall to the coolant. Preferably, the inner and outer walls 45, 48 form the outer walls of the liquid cooled alternator 14 integrated into the coolant crossover 12. However, the alternator could be provided with a separate outer wall (not shown), which is mounted in the opening 44 for cooling the alternator.

In use, the crossover member 12 is preferably mounted on opposite cylinder heads, or on other members, of a V-type engine with the inlet 26 connected with a port in one cylinder head and the outlet 28 connected with a port in the other cylinder head. Within the crossover 12, the coolant flows from inlet 26 to the EGR valve mount 32 with portion 41 and passage 42. Coolant then passes around the alternator opening 44 and across fins 50 between inner and outer walls 45, 48. The coolant then reaches the temperature sensor 18 and continues to the thermostat housing 20, where it is directed to a radiator bypass through outlet 28 or to the radiator through outlet 30 for cooling of the heated coolant. The crossover member body 12 is made of a suitable thermally conductive material so that the heat of exhaust gases in the EGR valve and the heat produced by the alternator in operation is conducted through the body 12 to the coolant in the passages 24, 42.

Figure 3 shows an alternative embodiment of coolant crossover assembly 52 with integrated liquid cooled alternator 14 and liquid cooled exhaust gas recirculation (EGR) valve 16. The liquid cooled alternator 14 is integrated with a coolant crossover 54 that is part of the intake manifold 56 for an integrated air fuel module 58 of a typical V-type internal combustion engine, not shown. The internal geometry of the coolant passage 24 and mounting of the alternator are similar to those shown in FIGS. 1 and 2 previously described. In like fashion an exhaust gas recirculation valve 16 is also integrated into the coolant crossover 54 of the intake manifold 56 and is cooled by the engine coolant via passages in the crossover. Exhaust gas from the EGR valve is discharged through the conduit 40 into the manifold 56.

While the invention has been described by reference to certain preferred embodiments, it should be understood that numerous changes could be made within the spirit and scope of the inventive concepts described. Accordingly, it is intended that the invention not be limited to the disclosed embodiments, but that it have the full scope permitted by the language of the following claims.

CLAIMS

1. An external coolant conduit member (12) for connection between engine components in a coolant circuit of an engine, said conduit member (12) comprising:

a body (12) mountable to said components and defining a coolant passage (24) extending between an inlet (26) and an outlet (28) to the passage (24) in the body;

a first mount (45, 46) for mounting an electrical generating device (14) to the body (12) in heat transmitting relation to the coolant passage (24) intermediate the inlet (26) and outlet (28); and

a second mount (32) for mounting a second engine accessory (16) to the body (12) in heat transmitting relation to the coolant passage (24) intermediate the inlet (26) and outlet (28).

2. An external coolant conduit member as in claim 1 wherein said first mount includes an inner wall defining a cavity in the body and mounting means for mounting said generating device in said cavity, said cavity being in heat transmitting relation to the coolant passage.

3. An external coolant conduit member as in claim 2 wherein said inner wall is essentially surrounded by said coolant passage.

4. An external coolant conduit member as in claim 3 wherein said inner wall includes cooling fins extending into said coolant passage for increasing heat transmission from said generating device.

5. An external coolant conduit member as in claim 2 wherein said inner wall acts as an outer wall of said generating device when installed in the member.

6. An external coolant conduit as in claim 1 wherein said coolant conduit member is a crossover for connection between coolant passages in opposite banks of a V-type engine.

7. An external coolant conduit coolant conduit assembly (10) for connection between engine components in a coolant circuit of an engine, said coolant conduit assembly (10) comprising:

a conduit member (12) mountable with said components and defining a coolant passage (24) extending between an inlet (26) and an outlet (26) in the conduit member (12);

an electrical generating device (14) mounted with the conduit member (12) in heat transmitting relation to the coolant passage (24) intermediate the inlet (26) and outlet (28); and

a second heat transmitting engine accessory (16) mounted in the conduit member (12) in heat transmitting relation to the coolant passage (24) intermediate the inlet (26) and outlet (28).

8. An assembly as in claim 7 wherein said conduit member includes an inner wall defining a cavity in heat transmitting relation to the coolant passage and said electrical generating device is mounted in the cavity.

9. An assembly as in claim 8 wherein said inner wall comprises an outer wall of the electrical generating device.

10. An assembly as in claim 7 wherein said inner wall includes cooling fins extending into said coolant passage for increasing cooling of the electrical generating device.

11. An assembly as in claim 7 wherein said electrical generating device is an alternator.

12. An assembly as in claim 7 wherein said second engine accessory is an EGR valve operable to control exhaust gas flow between inlet and outlet ports in the conduit member.

13. An assembly as in claim 12 wherein said coolant passage extends in heat exchange relation to at least a valve body portion of the EGR valve.

14. An assembly as in claim 7 wherein said conduit member is a crossover for connection between coolant passages in opposite banks of a V-type engine, said crossover also defining a thermostat housing in the coolant passage and mounting a coolant temperature sensor extending into the coolant passage.

15. An assembly as in claim 7 wherein said conduit member is integrated as part of an engine intake manifold.

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ABSTRACT

In a preferred embodiment, an engine coolant crossover assembly includes a crossover conduit member carrying an integral liquid cooled alternator and liquid cooled exhaust gas recirculation valve. The integration of one or both of these parts into the coolant crossover eliminates many parts from the total assembly. These parts include; attachment brackets, coolant hoses, hose clamps, cast mounting blocks, coolant tubes and attachment bolts. Reduction of these parts reduces system costs, assembly time, mass and potential coolant leak paths. A temperature sensor and a thermostat housing may also be included in the crossover assembly. The assembly may also be made part of an intake manifold for an integrated air fuel module of a V-type engine.

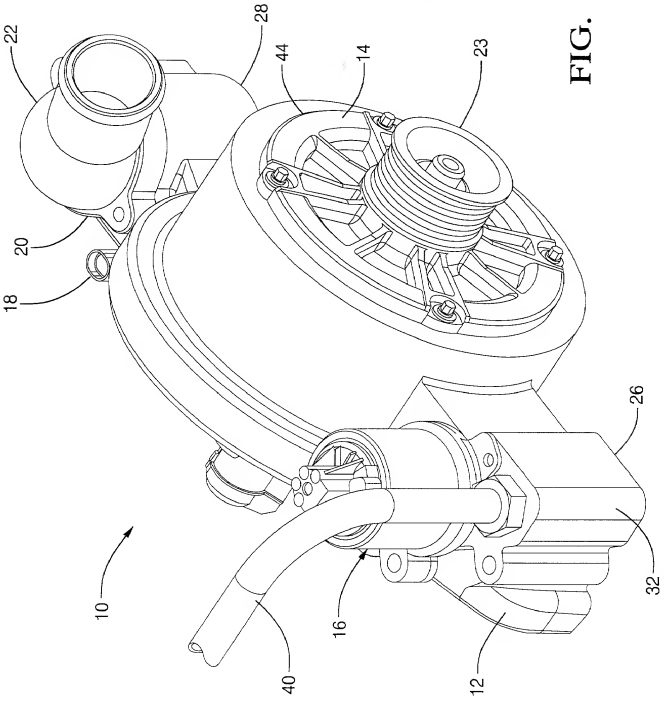

FIG. 1

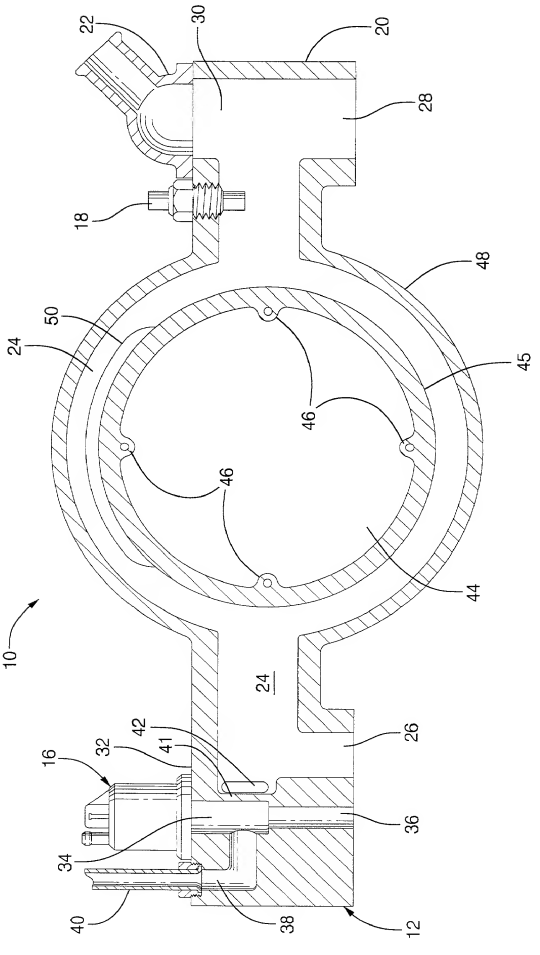

FIG. 2

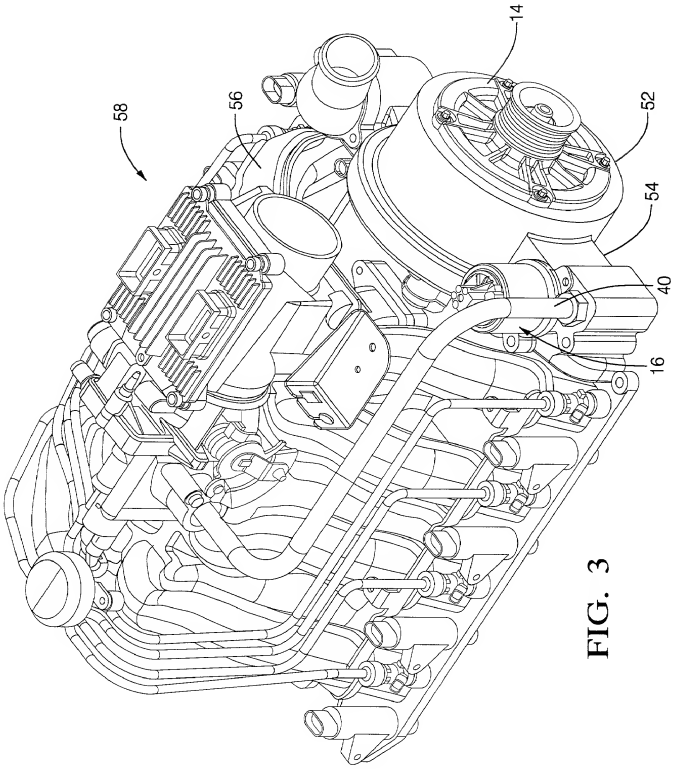

FIG. 3

DECLARATION and DESIGNATION OF CORRESPONDENCE ADDRESS

As an inventor named below, I hereby declare that:

My residence, post office address and citizenship are stated below next to my name.

I believe I am the original, first and sole inventor (if only one inventor is named below) or an original, first and joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought in the specification DP-300895 entitled

ENGINE COOLANT CONDUIT WITH INTEGRAL ALTERNATER AND EXHAUST GAS RECIRCULATION VALVE

I have reviewed and understand the contents of the above-identified specification including the claims, as amended by any amendment referred to in this Declaration.

I acknowledge my duty to disclose to the Patent and Trademark Office all information known to me to be material to patentability as defined in title 37 Code of Federal Regulations, Section 1.56.

I further declare that all statements made above of my own knowledge are true, that all statements made above on information and belief are believed to be true, and that these statements were made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under title 18 United States Code, Section 1001 and may jeopardize the validity of the application or any patent issuing thereon.

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